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Between "If" and "Then."

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TOWARDS A NEW SEMANTICS

This chapter is based on joint works with Sylvia Wenmackers and Igor Douven (Krzyżanowska et al. 2013, 2014).

3.1 MOTIVATIONS

Among the numerous theories of conditionals that have been proposed so far, none seems able to account for all the empirical data concerning how people use and interpret such sentences. As has been demonstrated in chapter (2), a theory of conditionals appears materially inadequate if it validates, in whichever precise sense, sentences like these:

- (69) a. If badgers are cute, then 2012 was a leap year.
- b. If weasels are people's best friends, then dogs have four legs.
- c. If Groningen is bigger than Kielce, Kazimierz Ajdukiewicz was a prominent Polish philosopher.

It is easy to understand why we are reluctant to accept conditionals like (69a), (69b) and (69c); the antecedents of those conditionals have nothing to do with their consequents. And it seems that using a conditional construction is meant to convey, possibly among other things, the existence of some sort of link between the content of the if-clause and the content of the main clause.

As has been already hinted at in the previous chapter, the most prominent theories of conditionals turn out to be untenable as descriptive accounts of the meaning of conditionals in natural language, because they fail to acknowledge the existence and the importance of a connection between the clauses of a conditional. Even these theories that capture some form of a dependence between a conditional's consequent and its antecedent, like the possible worlds semantics of Stalnaker (1968) or the suppositional theory advocated by, among others, Adams (1965, 1975); Edgington (1995) or Evans and Over (2004) fail to recognise its nature. In this chapter, I will attempt to characterise the link whose existence a conditional sentence seems to convey. Specifically, I

am going to propose a new semantics based on this characteristics and argue that it escapes certain undesirable consequences that hitherto proposed theories face. In chapter (5), I will discuss a famous argument by Allan Gibbard (1981), also known as the Gibbardian stand-off (Bennett 2003, p. 83–86), which led some to accept the idea that the meaning of a conditional is extremely subjective and others to entirely reject the possibility that conditionals express propositions. In the next chapter, I will also provide empirical evidence in support of this proposal.

3.2 BETWEEN A CONDITIONAL'S ANTECEDENT AND ITS CONSEQUENT

Although the most successful accounts of natural language conditionals tend to neglect the connection between the clauses of a conditional sentence, the idea that such a connection can be pertinent to the truth of a conditional is not entirely new to philosophy. Moreover, the nature of that connection could be characterised in a variety of ways. As observed by Douven (in press, p. 25 of the manuscript):

Candidate-answers abound: it could be logical, causal, explanatory, metaphysical, epistemic; or the “connector” could be a second-order functional property in that there is some first-order property or other that links antecedent and consequent, much in the way in which some have argued that truth is a second-order functional property, instantiated by correspondence to the facts in some domains of discourse, by assertability or verifiability in other domains, and by yet some other first-order property in again other domains.

According to a suggestion that has been repeatedly made in the history of philosophy, the link between a conditional's antecedent and its consequent is inferential in nature. That this idea has been dismissed as often as it has been floated may be due to the fact that it was always understood, implicitly or explicitly, that the inferential connection had to be of the same type—namely, deductive—for all conditionals.

Recently in experimental linguistics, a typology of conditionals has been proposed that takes seriously the aforementioned suggestion and argues that it is correct for at least a large class of conditionals, aptly termed “inferential conditionals” in the lin-

guistics literature, while also pointing out that the type of inferential connection may be different for different types of conditionals. In chapter (2), I have briefly introduced the most general distinction to be made when it comes to classifying conditionals, namely, the distinction between indicative and subjunctive conditionals, of which the paradigmatic cases are, to repeat the example, respectively:

- (13) a. If Oswald did not kill Kennedy, someone else did.
 b. If Oswald had not killed Kennedy, someone else would have.

For many theorists, this is only the beginning of a typology, though there is little unanimity as to what the typology should further look like. In linguistics, even if not so much in the philosophical or psychological literature on conditionals, it has become common practice to classify conditionals as *inferential* and *content* conditionals (see, among others, Dancygier 1998, 2003; Dancygier and Sweetser 2005; Declerck and Reed 2001; Haegeman 2003; Verbrugge 2007b). Inferential conditionals can be regarded as expressing a reasoning process, having the conditional's antecedent as a premise and its consequent as the conclusion, such as:

- (70) a. If she has not had much sleep recently, she will perform poorly on her exams.
 b. If he owns a Bentley, he must be rich.
 c. If all dogs have a good sense of smell, then your dog has a good sense of smell.

By contrast, the class of content conditionals is not particularly well defined. Its members are sometimes loosely said to describe relations between states of affairs or events as they happen in reality. This description is, however, too broad to allow for a demarcation of content conditionals from other types of conditional sentences.¹ Even though sentences such as:

- (71) a. If Alice never answers Bob's e-mails, he will get very disappointed with her.
 b. If you take ice out of the deep freeze, it melts.

¹ Douven and Verbrugge (2010, p. 303) also remain neutral on the question of whether what linguists identify as content conditionals constitute a genuinely different class of conditionals.

- c. If I manage to hand in the entire text by the end of this month, I will throw a party.

have been described as typical examples of content conditionals (Verbrugge 2007b, p. 4), it would seem that those may well be characterized in terms of inferential relations between their antecedents and consequents, and hence labelled as “inferential.” As will become clear later on (see section 3.3.2), the antecedent of a conditional does not need to be the only premise involved in the reasoning process expressed by that conditional. Due to their vague characteristics, content conditionals will not concern us here. Instead, we will limit our attention to inferential conditionals.

Even if not all conditionals encountered in natural language can be said to express a reasoning process, inferential conditionals certainly constitute a common type. Not surprisingly then, the idea that a conditional can be considered as somehow embodying a kind of “condensed argument” (Woods 2003, p. 15) is not altogether new to philosophy; it can be traced back at least to Chrysippus, a stoic logician from the third century BC. Chrysippus is believed to have held the view that a conditional is true if it corresponds to a valid argument² (Sanford 1989, p. 24). This idea seems to have been also endorsed by Ramsey (1990, p. 156) who, in the same text that gave rise to the famous Ramsey test, states that:

‘If φ , then ψ ’ can in no sense be true unless the material implication $p \supset q$ is true; but it generally means that $p \supset q$ is not only true but deducible or discoverable in some particular way not explicitly stated. This is always evident when ‘If φ then ψ ’ or ‘Because φ , ψ ’ (*because* is merely a variant on *if*, when φ is known to be true) is thought worth stating even when it is already known that φ is false or that ψ is true. In general we can say with Mill that ‘If φ then ψ ’ means that ψ is inferrible from φ , that is, of course, from φ together with certain facts and laws not stated but in some way indicated by the context.

Some authors, and most notably Mackie (1973, p. 69), claim that conditionals are not just linguistic devices that express arguments, but that they *are* arguments themselves, just in a truncated form.

² Note that this view can be also construed as paralleling the strict conditional account of Lewis (1918); see Sanford (1989, p. 69).

Also psychologists working in the mental models tradition seem to be endorsing a similar position. Braine (1978, p. 8), for instance, argued that:

The logical function of *if-then* is to state inference rules. *If ... then ...* is taken to be a grammatical frame such that, when the blanks are filled in with propositions (say, α and β), the result is the following inference rule:

$$\frac{\alpha}{\beta}$$

That is, if α has been established, then β can be immediately concluded. Thus, the logical function of *if-then* is taken to be the same as that of the inference line, that is, *if-then* and the inference line are different notations for indicating the same relation between two propositions. In effect, when one constructs an *if-then* sentence (say, if α then β), one is instructing one's hearers to add the inference rule, α/β , to their systems of propositional logic. Thus, *if ... then ...* is simply a convenient device that permits inference rules to be supplied ad hoc for the duration of their relevance (usually transient) to any matter at hand.

More recently, Johnson-Laird and Byrne (2002) claimed that for a conditional to be true, "the consequent *has* to occur given the antecedent" (p. 649, italics mine), which can be interpreted along the same lines.

An attempt to capture the connection between a conditional's antecedent and its consequent in terms of the relation of *relevance* as specified within the framework of relevance logics (Anderson and Belnap 1975) also seems to be an idea of the same kin. In fact, the development of this branch of logics has been motivated by the unintuitive consequences of the classical notion of entailment, and the paradoxes of material implication in particular, dubbed by the relevance logicians "irrelevance fallacies." As the name suggests, these logics (also referred to as "relevant" or "relevantistic," cf. Burgess (2009) or Mares (2014)) are meant to ensure that premises of an argument are *relevant* for its conclusion and, by the same token, an antecedent of an implication is *relevant* for its consequent. The relation of relevance is understood in purely logical terms: an antecedent φ is relevant for the consequent ψ if φ is involved in a proof of ψ (Anderson and Belnap 1975, p.

18). Hence, sentences like “If the moon is made of licorice, then it never rains in Warsaw” are false under the relevant interpretation: “The moon is made of licorice” cannot be a part of a proof of “It never rains in Warsaw.” The antecedent’s being blatantly non-sensical does not need to bother us either, since relevant logics do not validate *ex falso quodlibet*, that is, $\varphi \wedge \neg\varphi$ does not entail any arbitrary ψ .

Obviously, if the notion of a consequent’s following from an antecedent is to be understood strictly in terms of classical deductive inference, it is not hard to come up with counterexamples to the aforementioned idea. After all, indicative conditionals are most frequently a vessel for the kind of reasoning which is usually loaded with uncertainty. We assert sentences like “If you get vaccinated, you will not get sick,” or “If Mike passed the exam, he must have cheated,” on a regular basis, even though it would not be possible to prove their consequents from their antecedents. Thus, the relation of relevance needed to account for the meaning of natural language conditionals cannot be specified in terms of proofs.³ As has been demonstrated by Goodman (1955) by means of his famous “grue” / “bleen” puzzle, induction cannot be accounted for in purely syntactic terms, which would be needed to render the relevant implication any useful for the analysis of natural language conditionals. Goodman made his point by defining a new predicate, “grue,” that applies to all green objects examined before time t , and to all blue objects examined after t (p. 74). A green emerald provides inductive support to the hypothesis that all emeralds are green, but not to the hypothesis that all emeralds are grue. This discrepancy, however, cannot be explained in terms of differences between the logical forms of the two hypotheses, given that “All emeralds are green” and “All emeralds are grue” have exactly the *same* logical form. Instead, it stems from a difference in the *meanings* of the predicates “green” and “grue”—and this difference is beyond the scope of purely logical analysis.

It should be clear by now that theories of inferential conditionals must not neglect the fact that deduction is not the only type of inference people rely on in their reasoning. For this reason, finer-grained distinctions within the class of inferential conditionals are called for. Linguists have proposed various typologies of inferential conditionals (see, e.g., Declerck and Reed 2001), but most of these stem from grammatical distinctions and as such are not

3 See Oaksford and Chater (2007, p. 102) for a similar evaluation of the usefulness of relevance logic for the analysis of ordinary language conditionals and everyday reasoning.

suitable for our purposes. In the following section, I will present a differently based typology recently introduced by Douven and Verbrugge (2010), who acknowledge the variety of inferential relations that may exist between a conditional's antecedent and its consequent.

3.3 THE NEW TYPOLOGY OF CONDITIONALS

The first distinction Douven and Verbrugge make is between *certain* and *uncertain* inferences, where *certain* inferences guarantee the truth of the conclusion given the truth of the premises while *uncertain* inferences only tend to make the truth of the conclusion likely given the truth of the premises.

In Douven and Verbrugge's typology, the certain inferences coincide with the deductively valid ones. The uncertain inferences are, following standard philosophical practice, further divided into *abductive* and *inductive* ones. The deductive consequence relation is familiar from standard logic courses, and the non-deductive consequence relations have also received a fair amount of attention in the literature; see, for instance, Cialdea Mayer and Pirri (1993, 1995), Kyburg and Teng (2001), and Gabbay and Woods (2005). Still, there is much less agreement on how abductive and inductive inference are best explicated than agreement on how deductive inference is to be explicated.

For present purposes, it will suffice to say that abductive inferences are based on explanatory considerations and inductive inferences rely on information about frequencies (which may be more or less precisely specified). More exactly, in an abductive inference, we infer a conclusion from a set of premises because the conclusion provides the best explanation for those premises, that is, ψ is an abductive consequence of φ (given the background premises) if and only if ψ best explains φ (in light of the background premises). For example, we may infer that Sally failed her exam from the premises that Sally had an exam this morning and that she was just seen crying and apparently deeply unhappy. That she failed the exam is the best explanation for her apparent unhappiness. In an inductive inference, a conclusion follows from the premises with high statistical probability. In other words, ψ is an inductive consequence of φ (given the background premises) if and only if ψ follows with high statistical probability from φ (in light of the background premises). For instance, we infer that Yngwe speaks English fluently from the premise that he is Nor-

wegian because we know that by far the most Norwegians speak very good English. It is largely uncontested that people engage in abductive and inductive inferences on a routine basis, even though it still is a matter of some controversy how to best characterize the notions of abductive and inductive validity and which psychological processes are involved in the said kind of inferences. Douven and Verbrugge do not commit to any specific proposals in this regard, and we will not do so here either.

Douven and Verbrugge's typology of inferential conditionals mirrors the aforesaid typology of inference. That is to say, they distinguish between certain (or deductive) and uncertain inferential conditionals, and then divide the latter class further into abductive and inductive inferential conditionals.⁴ More specifically, they propose the following:

DEFINITION 1: *A sentence "If φ , then ψ " is*

- *a deductive inferential (DI, for short) conditional if and only if ψ is a deductive consequence of φ ;*
- *an inductive inferential (II) conditional if and only if ψ is an inductive consequence of φ ;*
- *an abductive inferential (AI) conditional if and only if ψ is an abductive consequence of φ .*

Douven and Verbrugge also point out that, often, the inferential relation between antecedent and consequent partly relies on the antecedent φ together with background premises that are assumed to hold in the context in which the conditional is asserted or evaluated. They call such conditionals *contextual* DI, AI, or II conditionals, depending on the type of inference involved.

DEFINITION 2: *Where $\mathbf{K} = \{p_1, \dots, p_n\}$ is the set of salient background premises, "If φ , then ψ " is*

- *a contextual DI conditional if and only if ψ is a deductive consequence of $\{\varphi\} \cup \mathbf{K}$;*
- *a contextual II conditional if and only if ψ is an inductive consequence of $\{\varphi\} \cup \mathbf{K}$;*
- *a contextual AI conditional if and only if ψ is an abductive consequence of $\{\varphi\} \cup \mathbf{K}$.*

For example, considered on its own, ψ may fail to explain φ , but in light of all that one knows, ψ may be the best explanation

⁴ Note that this typology is not necessarily exhaustive. Following Douven and Verbrugge, we remain non-committal as to whether conditionals expressing, for instance, causal or analogical inferences should be analysed as separate types or as subclasses of, say, inductive inferential conditionals.

of ϕ . If so, then “If ϕ , ψ ” qualifies as a contextual AI conditional, where the relevant context is provided by one’s current belief state. Moreover, as Douven and Verbrugge (2010, p. 304) note, in contextual AI conditionals, the consequent need not always be the best explanation of the antecedent. It may also be that the consequent is, *in light of the antecedent*, the best explanation of one of the background assumptions.

What Douven and Verbrugge do not note in their 2010 paper (and what is also not important for their purposes) is that there can be an inferential connection between antecedent and consequent which involves inferences of more than one of the aforementioned types. For example, in some conditionals the consequent may follow from the antecedent via an abductive step *and* a deductive step. In cases of this kind, we may say that the consequent is a mixed consequence of the antecedent. It is important to note that as soon as either abductive or inductive steps are involved, the conditional is to be grouped with the uncertain inferential conditionals.

3.3.1 Douven and Verbrugge’s experiment

Douven and Verbrugge do not claim that their typology of inferential conditionals is *correct* and the ones that so far have been propounded by other theorists are *incorrect*. What they do claim is that their typology is exceedingly simple and that it is non-ad hoc in that it relies on a time-tested distinction between types of inference. More importantly still, they show in their 2010 paper that the typology has considerable explanatory force by recruiting it in service of testing (what is generally called) Adams’ Thesis, briefly discussed in section 2.4.

According to this thesis, first proposed by Adams (1965) and championed by many since, the acceptability of a conditional is measured by the probability of its consequent conditional on its antecedent. In their experiment, Douven and Verbrugge divided the participants into two groups, asking one group to judge the acceptability of ten DI, ten AI, and ten II conditionals (see Figure 1 for an example) and the other group to judge the corresponding conditional probabilities (Figure 2).⁶

For all sentences taken together, Douven and Verbrugge were able to disprove Adams’ Thesis both in its strict form and in some

⁶ See Appendix A of Douven and Verbrugge (2010) for the full materials used in this experiment.

CONTEXT: You strongly doubt that Hank will have passed the first- year examination. You suspect that his parents will buy him a car only if he passed that examination. You suddenly see Hank driving a new car.

CONDITIONAL: If the car Hank is driving is his, then he passed the first-year examination.

Indicate how acceptable you find this conditional in the given context:

| | | | | | | | | | | |
|--------------|---|---|---|---|---|---|---|--|--|-------------------------|
| Highly | | | | | | | | | | Highly |
| unacceptable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | | acceptable ⁵ |

Figure 1: An example of a question asking for the acceptability of an AI conditional from the experiment of [Douven and Verbrugge \(2010\)](#).

of its looser forms. That is to say, where Ac stands for the degree of acceptability of a sentence and Pr for the probability operator, they demonstrated that neither is it generally true that

$$Ac(\text{If } \varphi, \psi) = Pr(\psi | \varphi) \quad (7)$$

nor that

$$Ac(\text{If } \varphi, \psi) \approx Pr(\psi | \varphi) \quad (8)$$

nor that

$$\begin{aligned} &Ac(\text{If } \varphi, \psi) \text{ is high (middling / low)} \\ &\text{iff } Pr(\psi | \varphi) \text{ is high (middling / low)} \end{aligned} \quad (9)$$

Splitting out the results for the three types of conditionals showed that Adams' Thesis in its strict form holds only for DI conditionals. For AI conditionals the most that can be said is that acceptability and conditional probability are highly correlated. For II conditionals not even that much was found to be true.

The typology of inferential conditionals proposed by Douven and Verbrugge explains the systematic differences in the acceptability judgements of different types of conditionals. We take these

CONTEXT: You strongly doubt that Hank will have passed the first- year examination. You suspect that his parents will buy him a car only if he passed that examination. You suddenly see Hank driving a new car. Suppose the car Hank is driving is his.

SENTENCE: Hank passed the first-year examination.

Indicate how probable you find this sentence in the given context:

| | | | | | | | | | | |
|------------|---|---|---|---|---|---|---|--|--|----------|
| Highly | | | | | | | | | | Highly |
| improbable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | | probable |

Figure 2: An example of a question asking for the conditional probability from the experiment of Douven and Verbrugge (2010).

results to be evidence for the significance and cognitive plausibility of the typology.⁷ The deeper explanation of these results might be in terms of acceptability conditions, which might be different for the different types of conditionals, or in terms of truth conditions, which might also be different for the different types. The idea that the different types of inferential conditionals have different truth conditions will be explored in the following section. In chapter 4, I aim to provide further support for this typology by relating it to the use of certain linguistic expressions that in the literature have been identified as evidential markers or that can reasonably be assumed to act as such markers. Chapter 5 will demonstrate how the new semantics built upon this typology helps to evade an old philosophical puzzle.

⁷ Note that by taking its explanatory force as evidence for the typology we are relying on abduction. While neither for the purposes of Douven and Verbrugge's (2010) paper nor for the current use we are making of their proposal is it necessary to make any assumptions about the confirmation- theoretic status of abduction, for independent reasons we do believe that abduction is in much better normative standing than is generally believed. See Douven (2013) and Douven and Wenmackers (in press).

3.3.2 *A note on content conditionals*

At the beginning of the section 3.3, we noted that the distinction between inferential and content conditionals is not particularly clear-cut. Upon a closer look at the sentences used in the investigations of differences in production and comprehension of content and inferential conditionals (see, e.g., Verbrugge 2007a,b; Verbrugge et al. 2007), we can observe that content conditionals constitute a very heterogeneous class. For instance, Verbrugge (2007b, p. 106) contrasts the following, allegedly, content conditionals:

- (72) a. If she runs down the stairs from the sixth floor, she'll be exhausted.
- b. If he is in hospital, they will help him recover.

with inferential sentences:

- (73) a. If she runs down the stairs from the sixth floor, she is in a hurry.
- b. If he is in hospital, he has had an accident.

However, in the light of the above proposed definitions 1 and 2, conditionals in (72) are of inductive inferential type. For instance, that someone will receive help leading to recovery can be inferred inductively from the assumption that the person is in hospital in conjunction with background knowledge on what he suffers from, how effective hospitals are in treating the issue in question, etc. The conditionals in (73) are, on our proposal, also of a specific type, namely, abductive inferential.

This is not to say that all sentences labelled “content conditionals” in psycholinguistic literature can be reduced to inferential conditionals. Verbrugge et al. (2007, Appendix 2, pp. 130–131) presents a broader selection of conditionals from this class, grouped into promises, tips and causal sentences (incidentally, all the instances of conditionals labelled as inferential are, in fact, abductive inferential). It seems that all the content conditionals grouped as causal sentences, e.g., “If the landlord turns up the thermostat, it will become warm in my room,” can be easily interpreted as inductive inferential conditionals, and the same can be said about two out of four content conditionals falling under the category of tips, e.g., “If you pay attention, you will learn a lot.” However, the following examples from Verbrugge et al. (2007, *ibid.*) cannot be so easily analysed in terms of inferential connections between their antecedents and the consequents:

- (74) a. If you write my essay, I will help you with your maths exercises.
- b. If you get married in Church, we will pay for the wedding party.
- c. If you want concrete information, take a look at the website.
- d. If you want to impress him, wear your new perfume.

Sentences (74a) and (74b) fall under the category of promises while (74c) and (74d) are tips. But they are not only conditionals that serve the purpose of being a promise or a tip, they are conditional promises and conditional tips, respectively. Together with conditional threats, commands, questions, and the like, these can be classified as *speech-act conditionals*, which are:

cases where the *if*-clause appears to conditionally modify not the contents of the main clause, but the speech act which the main clause carries out (Dancy-gier and Sweetser 2005, p. 113).

As has been indicated earlier, performatives are beyond the scope of this thesis, and thus is the issue of telling speech-act and content conditionals apart. Whether, however, a subclass of content conditionals needs to be discerned from the class of declarative indicative conditionals and contrasted with inferential ones is an empirical question which, for the time being, will remain open.

3.4 TRUTH CONDITIONS

The semantics that we want to propose takes its cue from the aforementioned idea according to which a conditional is true if and only if its consequent follows from its antecedent. This idea was meant to do justice to the broadly felt intuition that there must be some kind of internal connection between a conditional's antecedent and its consequent if that conditional is to count as true. Our proposal aims to avoid the above discussed problems by doing justice to the fact that a consequent's following from an antecedent may be understood in terms of a number of different inferential connections, including but not limited to deductive inference.

In doing so, we are following the lead of Douven and Verbrugge (2010) in distinguishing between deductive inferential (DI), in-

ductive inferential (II), and abductive inferential (AI) conditionals.

While, to our minds, the typology of consequence relations introduced in section 3.3 is directly relevant to the semantics for conditionals, it may be difficult to capture this relevance by the standard model-theoretic means, if only because there is currently no satisfactory model-theoretic characterization of best explanation. But there is an alternative tradition in semantics, one that uses proof theory instead of model theory for the purposes of explicating meaning. This tradition is best known for its claim that the meanings of the logical constants are given by the standard introduction and elimination rules for these constants.

Our suggestion is *not* that the standard introduction and elimination rules for the conditional operator from propositional logic give us the semantics for the conditional; that would amount to endorsing the material conditional account, which we have already dismissed. Rather, the idea is to state truth conditions for conditionals directly in terms of the various mentioned consequence relations. Doing so helps to amend in two ways the traditional idea that was our starting point, to wit, by relaxing the requirement that a conditional's consequent follows *deductively* from its antecedent for the conditional to be true, and by acknowledging the role the background plays in determining whether or not a conditional's consequent follows from its antecedent. To be precise, the proposed semantics is that:

DEFINITION 3: *A speaker S's utterance of "If φ , ψ " is true if and only if*

- (i) *ψ is a consequence of φ in conjunction with S's background knowledge,*
- (ii) *ψ is not a consequence of S's background knowledge alone but not of φ on its own, and*
- (iii) *φ is deductively consistent with S's background knowledge or ψ is a consequence of φ alone,*

where the consequence relation can be deductive, abductive, inductive, or mixed.

Note that we are requiring background *knowledge* and not merely background *beliefs*: it would be counter-intuitive to designate the utterance of a conditional as true if its consequent followed (in any of the mentioned senses) from its antecedent in conjunction with false beliefs that the speaker may have.

Clauses (ii) and (iii) are meant to ensure that the antecedent is not redundant in the derivation of the consequent, respectively, that the consequent does not follow trivially from the antecedent plus background knowledge. Without them, one could still have true conditionals without any intuitive inferential connection between antecedent and consequent. As for clause (ii), note that the proposal would be too restrictive if we demanded simply that the consequent not follow from the background knowledge alone. While we do want to keep from qualifying as true

- (75) If Milan Kundera is a candidate for the 2016 Nobel Prize in Literature, then the earth weighs more than 2 kilograms.

we do *not* want to keep from qualifying as true

- (76) If the earth weighs more than 3 kilograms, then it weighs more than 2 kilograms.

The consequent of these conditionals follows (in almost any context) from background knowledge alone. However, in (76) it also follows from the antecedent, which is enough to ensure the intuitively required inferential link, whereas in (75) antecedent and consequent have nothing to do with each other, which at least on our hypothesis accounts for the felt falsity of this sentence. The proposal would also be too restrictive if clause (iii) simply required that the antecedent be deductively consistent with the background knowledge. The conditional

- (77) If the UK is ruled by a king, then it is a monarchy.

seems true, even if its antecedent is inconsistent with background knowledge. By contrast,

- (78) If the UK is ruled by a king, then Milan Kundera will be a candidate for the 2016 Nobel Prize in Literature.

seems false, notwithstanding the fact that its consequent follows deductively, by virtue of *ex falso quodlibet*, from its antecedent together with the background knowledge that the UK is (currently) ruled by a queen; whether Milan Kundera will be nominated for the 2016 Nobel Prize in Literature, has, as far as we can see, *nothing* to do with whether the UK is ruled by a king.

3.5 LIMITATIONS AND MERITS

As the proposal stands, conditionals with a necessarily true consequent as well as those with a necessarily false antecedent still

qualify as true. Thus, clauses (ii) and (iii) do not quite ensure what they are intended to ensure. But perhaps that is as it should be. We do not have strong intuitions about whether, say,

- (79) a. If $2 + 2 = 5$, Milan Kundera will be a candidate for the 2016 Nobel Prize in Literature.
- b. If raccoons are American mammals noted for their intelligence, 41 is a prime number.
- c. If π is a rational number, $23 + 7 = 30$.

are true or false. Those who do have a strong intuition that these sentences are false could still consider dealing with this type of conditional by appealing to Gricean pragmatics.⁸ More generally, we would not be hugely surprised if clauses (ii) and (iii) needed further fine-tuning.

The first clause of Definition 3 may be considered the gist of the current proposal. This clause raises some tangled issues by itself, in particular in relation to II conditionals, that is, conditionals whose consequent is an inductive consequence of their antecedent. To mention a pressing one, few might want to say that a speaker informed about the circumstances of a fair and large lottery could truly assert the II conditional:

- (80) If you buy a ticket, you will lose.

however many tickets there are in the lottery and however low the chances are of winning the lottery (Lowe 1996). Of course, this may just mean that some clause is to be added to our proposal. Alternatively, one might try to argue that the intuition that (80) cannot be truly asserted is to be explained in terms of this conditional's not being assertable in the first place, which in turn may have an explanation along Gricean lines (Douven 2012b). We flag this potential difficulty here only to set it aside for future research.

The above mentioned issues notwithstanding, we would like to point out some attractive features of Definition 3. First, note that it has no difficulty blocking the paradoxes of material implication like, for instance:

⁸ Some might think that Gricean pragmatics on its own is capable of accounting for the intuition that there should be a link between a conditional's antecedent and consequent if that conditional is to count as true. However, see Douven (2008) for an argument to the effect that no currently known pragmatic principle can do the required job.

- (51) a. If summits of all 14 eight-thousanders have been reached in winter, then Nanga Parbat has never been climbed in winter.
- b. If my only sister is 5 years older than me, then I have a younger sister.
- c. If Lithuania is reigned by a king, then it is not a monarchy.

discussed in section 2.2. Because ψ may be true without there being any inferential connection between it and φ , “If φ , ψ ” need not be true just because ψ is true. Nor does the truth of the conditional follow from the mere falsity of φ , as that does not either ensure the existence of an inferential connection between φ and ψ . Hence, the following conditionals:

- (52) a. If aubergine is a species of small birds, then most Belgians speak Basque.
- b. If Orhan Pamuk did not win the Nobel Prize in literature, then he is not a writer.
- c. If raccoons are not American mammals noted for their intelligence, then they are not animals.

discussed earlier as instances of conditionals that, if interpreted materially, are true due to their false antecedents, are rendered false on our account. And so are instances where strengthening the antecedent yields counterintuitive consequences. Of the following sentences,

- (46) a. If Molly got an A for the logic course, her parents are proud of her.
- b. If Molly got an A for the logic course and failed all the other courses, her parents are proud of her.

the first can be true, since one can inductively infer that Molly’s parents are proud of her from the premise that she got an A for the logic course, given some background information about Molly’s parents being concerned about their daughter’s grades. Yet such a conclusion does not follow any more, not even inductively, when the set of premises is expanded by the information that Molly failed all the other courses. Induction and abduction are non-monotonic types of inference, thus the proposed

semantics does not validate the rule of strengthening of the antecedent: the truth of a conditional “If φ , ψ ” does not suffice for the truth of a conditional whose antecedent is a conjunction of φ and an arbitrary χ .

Furthermore, although the semantics does not validate the *Or-to-if* principle since, as has been shown by, e.g., Stalnaker (1975) or Edgington (1995, p. 242–243)⁹ it is possible only for the truth-functional account, this does not have to be seen as a shortcoming. In fact, the semantics does get the *Or-to-if* inferences right precisely in the kind of cases in which it is intuitively right. According to this principle, “If φ , ψ ” can be inferred from “Not- φ or ψ .” Now, if ψ follows from the background knowledge alone in a context, then so does “Not- φ or ψ .”¹⁰ However, given clause (ii) of Definition 3, it still does not follow that “If φ , ψ ” is true in that context; it is *not*, unless ψ also follows from φ alone. Similarly if not- φ follows from the background knowledge. Then even though “Not- φ or ψ ” follows from that background knowledge as well, it does, given clause (iii), *not* follow that “If φ , ψ ” is true in the given context; it is *not*, unless ψ follows from φ alone. Note, however, that in these two kinds of situations it is not intuitively all right to infer “If φ , ψ ” from “Not- φ or ψ ”: if we know that the butler did it, we do not want to infer that if the butler did not do it, then the maid did; nor do we want to infer this if we know that the maid did it. Moreover, this observation seems to fit the empirical data on how people infer conditionals from disjunctions. As shown by Over et al. (2010), people tend not to accept a conditional as a conclusion of an argument when a disjunction given as a premise is justified constructively, that is, one if its disjuncts is known, which may be taken to suggest that a theory of conditionals aiming at descriptive accuracy does not need to validate the *Or-to-if* inference as a general principle. On the other hand, sometimes it is perfectly all right to apply the *Or-to-if* principle, namely, in the kind of case in which neither not- φ nor ψ follows from the background knowledge though their disjunction does. And given Definition 3, “If φ , ψ ” is true in that case, for given “Not- φ or ψ ,” there is an inferential connection—to wit, via Disjunctive Syllogism—from not- φ to ψ .¹¹

⁹ See section 2.2 for a reconstruction of the argument.

¹⁰ We are assuming knowledge to be closed under classical entailment.

¹¹ See also Gilio and Over (2012), who analyse the *Or-to-if* inference from the probabilistic perspective. They demonstrate that $\Pr(\text{If not-}\varphi \text{ then } \psi)$, which is usually judged to be the conditional probability $\Pr(\psi \mid \varphi)$, is “close to” $\Pr(\varphi \text{ or } \psi)$ when

Finally, the new semantics validates the so-called Import–Export principle, according to which “If ϕ and ψ , χ ” and “If ϕ , then if ψ , χ ” are equivalent. This principle is of utmost importance for the advocates of non-propositional theories of conditionals (see, e.g., [Gibbard 1981](#); [Edgington 1995](#)), since they cannot allow for conditionals embedded by means of Boolean operators. The empirical fact that English speakers do utter iterated conditionals like:

- (81) a. If there are days when the sun does not set at all, then if you are on the Northern Hemisphere, you are north from the Arctic Circle.
- b. If it starts raining, then if you don’t take your umbrella, you will get wet.
- c. If Julian stands up to his boss, then if he gets fired, he will regret that.

seems hard to deny. Assuming the Import–Export principle, the above sentences can be paraphrased as the following simple conditionals:

- (82) a. If there are days when the sun does not set at all and you are on the Northern Hemisphere, you are north from the Arctic Circle.
- b. If it starts raining and you don’t take your umbrella, you will get wet.
- c. If Julian stands up to his boss and gets fired, he will regret that.

Import–Export seems not only intuitively appealing, but it is also supported by empirical evidence [van Wijnberger-Huitink et al. \(in press\)](#).¹²

To see why the Import–Export is valid on our account, let “If ϕ and ψ , χ ” be given. Then χ can be inferred (in the broad, generalized sense) from the conjunction of ϕ and ψ ; let Δ be the name of

“ ϕ or ψ ” is justified non-constructively. However, it is not the case when the disjunction is justified constructively.

¹² See, however, [Douven and Verbrugge \(2013\)](#) whose results somewhat undermine the descriptive accuracy of the Import–Export principle. They found a significant difference between the probability ratings of a conditional, “If q , then r ,” given a certain proposition p and the probability ratings of the consequent of that conditional, r , given the conjunction of p with q . According to [van Wijnberger-Huitink et al.](#), this discrepancy could be explained by the fact that Douven and Verbrugge used thematic materials, so the participant’s responses were more likely to be influenced by pragmatic considerations.

one way to derive χ from the conjunction of φ and ψ . Then from φ we can infer that χ can be inferred from ψ . After all, given φ as a premise, we can assume ψ and form the conjunction of φ and ψ . Then we can use Δ to derive χ from that conjunction. Discharging ψ yields that “If ψ , χ ” can be inferred from φ .¹³ And this means that “If φ , then if ψ , χ ” is true. Conversely, let “If φ , then if ψ , χ ” be given. Then from φ we can infer that χ can be inferred from ψ . Supposing the conjunction of φ and ψ , we first infer from φ that χ can be inferred from ψ and then use that and ψ to infer χ . Thus we infer χ from the conjunction of φ and ψ , which is enough for the truth of “If φ and ψ , χ .”

One may wonder, however, what remains on the present proposal of the intuition that Modus Ponens is a valid rule of inference for conditionals (and not just for the material conditional). By relaxing the requirement of previous semantics that the inferential connection between antecedent and consequent be deductive, our semantics makes room for the possibility that a true conditional has a true antecedent and a false consequent. After all, what distinguishes deduction from induction and abduction is that deduction guarantees the truth of any conclusion reached on the basis of true premises. But this means that Modus Ponens may lead from true premises to a false conclusion, and hence that the rule is not valid in the classical sense of guaranteeing preservation of truth.

In response, first note that the validity of Modus Ponens has been challenged on independent grounds by McGee (1985) and Lycan (2001, Ch. 5).¹⁴ More importantly, even if abduction and induction are not *guaranteed* to preserve truth, we rely on them in daily practice because we take them to be reliable guides to the truth; that is, we trust them to preserve truth with high probability. If we are right to trust these modes of inference, then, supposing our semantics, in the vast majority of cases in which we apply Modus Ponens to a conditional with a true antecedent, its consequent will be true as well. That may be all there is to the intuition that Modus Ponens is a classically valid rule of inference—and it may be all that matters for practical purposes. Epistemologists have observed that people’s knowledge attributions often

¹³ This assumes the validity of Conditional Proof for the conditional, that is, that we may conclude “If φ , ψ ” if we can infer (still in the relevant broad sense) ψ from φ . But Conditional Proof is trivially valid on the present account, which explicitly makes it sufficient for the truth of a conditional that its consequent can be inferred from its antecedent.

¹⁴ See also section 2.2 of the previous chapter.

appear to be context-dependent (see [Decock et al.](#), in press, and references given there). In particular, whether something is considered to be knowledge seems to hinge on what is at stake. By the same token, whether a conclusion of a Modus Ponens inference will be perceived as correct may be subject to contextual variation. And as it is the case with what we habitually call “knowledge,” it is most of the time good enough.

Yet, in some contexts, it may be vital to act on what is absolutely certain rather than just very likely. Does it then mean that, if Modus Ponens is only a reliable heuristics and not a truth-preserving rule of inference, we should entirely refrain from relying on it in this kind of contexts? But is Modus Ponens only a reliable heuristics throughout?

As our theory recognises different types of consequence relation that can connect a conditional’s antecedent and consequent, it can also distinguish between the classes of conditionals for which Modus Ponens is valid and those for which it is not. Specifically, there is no reason to deny the validity of Modus Ponens when its scope is limited to the class of DI conditionals, that is, conditionals whose consequents follow deductively from their antecedent. More precisely, if a DI conditional “If φ , ψ ” is true given some background premises $\{\varphi_0, \dots, \varphi_n\}$, then one can infer ψ from φ , assuming that the background premises, $\{\varphi_0, \dots, \varphi_n\}$, still hold.¹⁵

This observation would not be of any use, however, if we had no way to tell different types of conditionals apart. In the following chapter, we will discuss an empirical study on linguistic markers that allow to distinguish between DI, AI and II conditionals.

¹⁵ In other words, applying Modus Ponens to a contextual DI conditional requires the minor premise to be the antecedent φ in conjunction with the background premises $\{\varphi_0, \dots, \varphi_n\}$.